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The Color Preferences of Psychiatric Groups

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SAMUEL J. WARNER

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CHAPTER I

INTRODUCTION

Some remarkable findings have resulted from investigations of the color preferences of psychiatric groups. It was discovered that a group of manics rated red first in order of preference, while the depressed rated red last (Shikiba, 10); and that manic-depressives preferred red more strongly than did schizophrenics (Katz, 7).

For those of us who seek dimensions of value in differential diagnosis, such findings stimulate the imagination. One wonders whether bases exist in color preferences for test items of diagnostic value. When, with this in mind, one examines prior investigations in this area for definite evidence on the subject, the results are disappointing. These investigations may be said to suffer from serious inadequacies in the following two areas: *sampling of subjects* and *control of colored materials.*

As to the first of these limitations, sampling, we find that Katz (7) does not describe the sizes of his individual psychiatric groups (but a number of signs point to the strong likelihood that the sizes of his manic and depressed groups were small); while Shikiba (10) employed samples of but twenty-six manic and ten depressed patients. Moreover, the sexes are not equally represented in Shikiba's psychiatric groups, while Katz makes no mention of whether or not this control was observed in his investigation (and the present study indicates the prime importance of this factor). In both studies comparisons are made that imply meaningful differences, but no measures of the statistical significance of such differences are presented. We are forced to conclude that these studies do not provide bases for judging whether the differences observed between the psychiatric groups may be accepted as valid. We simply do not know the likelihood that these differences might have been obtained purely on the basis of chance.

The second limitation of prior research in this area—that of the control of colored materials—arises from the fact that color may be differentiated into three discrete psychological dimensions: *hue, lightness,* and *saturation.* Even if it were true that the findings cited were valid, these would still be of minimal value, for we would not know whether the differences in preferences displayed were due to differences in hue, differences in lightness, differences in saturation, or to combinations of these; since both studies cited did not contain lightness or saturation series, and the Milton-Bradley coated papers (7) and Zimmerman colors (10) used did not provide for holding lightness and saturation constant in the hue series.

The preceding two paragraphs indicate the aim of this investigation: to attend to sampling considerations on the one hand, and to color controls on the other—to the end that the relationships between some psychiatric groups and color preferences may be explored in a definitive manner. Such definitiveness is sought in terms of the following two attributes: the existence of measures describing the probable magnitudes of errors of the statistics employed; and the differentiation of the data into those that relate to differences in hue, to differences in lightness, and to differences in saturation.

The equipment used in this study was constructed at the University of Chicago during the summer of 1947. The psychiatric patients who served as subjects were tested during the period extending from the fall of 1947 through the spring of 1948 at the following hospitals and clinics: Rockland State Hospital, Orangeburg, New York; Brooklyn State Hospital, Brooklyn, New York; Creedmoor State Hospital, Queens Village, Long Island, New York; Israel Zion Hospital, Brooklyn, New York; Manhattan State Hospital, New York, N.Y.; William Alanson White Clinic of the Long Island College of Medicine, Brooklyn, New York; The Brooklyn Hospital, Brooklyn, New York; Hillside Hospital, Bellerose, New York; Elgin State Hospital, Elgin, Illinois; Manteno State Hospital, Manteno, Illinois; Kankakee State Hospital, Kankakee, Illinois, Forest Sanitarium, Des Plaines, Illinois.

CHAPTER II

MATERIALS AND METHODS OF PROCEDURE

THE method of paired comparisons was employed, which, although less economical than other available methods of presentation, was believed to offer the greatest likelihood of yielding valid measures of the color preferences of disturbed patients.

Munsell Standard Papers, in the form of 5 in. by 8 in. rectangles, were mounted on 12 in. by 20 in. backgrounds of Milton-Bradley neutral-gray (No. 1042) paper. These were reinforced with pasteboard backings. A raised border, 1/16 in. high, ½ in. wide, faced with the same Milton-Bradley paper, ran along the edges of each background. A ½ in. by 11 in. strip, similarly placed, separted the horizontal halves of the 12 in. by 20 in. backgrounds. This raised border and center strip were necessary to protect the Munsell Standard Papers from abrasion.

The long axis of each 12 in. by 20 in. card was held horizontal during exposure. To these cards the Munsell rectangles were secured with rubber cement, in positions equidistant from the horizontal edges of the backgrounds; with inner edges placed symmetrically about and 2½ in. from the vertical axes of these backgrounds. The longer axis of each Munsell rectangle was vertical.

The colors were exposed in a ¼ in. ply-wood enclosure whose outer dimensions for height, width, and depth are 28½ in. by 26 in. by 17 in. respectively. This was painted, both inside and out, with a neutral-gray flat paint which was matched to the Munsell $N5$ specification. Each Munsell rectangle was illuminated by a 25-watt daylight-blue Mazda lamp. A line connecting each lamp with the center of the rectangle that it illuminated was approximately 10 in. in length, and fell approximately in a plane perpendicular to the face of the colored rectangle. This same line made an angle of 45 degrees with the vertical axis of the colored rectangle.

A ply-wood partition, whose outer edges were flush with the inner surfaces of the enclosure, and whose outer surface was 3 in. from the edge of the enclosure nearest the subject, prevented the direct light of the lamps from reaching the subject. Out of this partition was cut an 8½ in. by 15½ in. rectangular space whose longer axis was horizontal and was bisected by the vertical mid-line of the partition; and whose lower edge was 12 in. from the base of this partition. A four-sided wooden enclosure, whose inner dimensions were equal to those of the cut-out, was attached to the partition so that its inner surfaces were flush with those of the cut-out. This four-sided enclosure extended 5 in. to the rear. The effect of these restrictive devices were such that when the subject sat in the usual position his field of vision included each Munsell color, which was framed on all sides by a border of Milton-Bradley neutral-gray paper measuring approximately 1½ in., and which was framed in turn by the neutral-gray ply-wood partition.

A vertical panel separated the left and right halves of the enclosure so that was illuminated solely by one of the two lamps. The front facing of this enclosure was hinged at the bottom, so that when setting up, the investigator allowed this facing to fall forward, exposing on its inner surface a set of electric push-buttons. These were simple two-way switches. The one on the right turned off the lamp on its side, and the one on the left did likewise. A set of two-way toggle switches, located on the rear surface of the apparatus, allowed the investigator to re-make either circuit broken by the subject. The entire apparatus fitted on an ordinary desk. The subject sat at one end of the desk and the investigator at the other. Shades were drawn when the experiment was in progress, and light for the investigator's use was supplied by a small desk-lamp, which was shielded from the subject's view by the wooden enclosure.

A rear panel, 17½ in. by 26 in., hinged at the bottom, supported a 3½ in. ledge, on which the colors were placed. In changing colors this panel was pulled to the rear, and the foremost card was removed. This allowed the next of the fifteen cards held on the shelf to be viewed when lighting permitted. An electric switch broke the circuit automatically when the panel was opened, so that the subjects could not see the colors during the change.

Since the push-buttons were fixed to the front drop-panel at about 40 in. from the plane of the colored papers, and since the subject generally sat with one hand on each of the push-buttons, this located the subject's eyes at approximately 52 in. from the Munsell colors.

The center of each colored rectangle was 15 in. from the bottom of the enclosure. This distance, added to the height of the ordinary desk upon which the enclosure was generally placed, brought the height of the center of each colored rectangle to approximately that of the eye-level of the average seated subject.

The definitions offered at this point of the terms to be employed in this study in reference to the psychological dimensions of color are those recommended by the Colorimetry Committee of the Optical Society of America (11).

> *Color* is the general name for all sensations arising from the activity of the retina of the eye and its attached nervous mechanisms, this activity being, in nearly every case in the normal individual, a specific response to radiant energy of certain wave-lengths and intensities . . . *Hue* is that attribute of certain colors in respect of which they differ characteristically from the gray of the same brilliance and which permits them to be classed as reddish, yellowish, greenish, or bluish . . . *Brilliance* is that attribute of any color in respect of which it may be classed as equivalent to some member of a series of grays ranging between black and white . . . *Saturation* is that attribute of all colors possessing a hue, which determines their degree of difference from a gray of the same brilliance.

It is to be noted that these three dimensions of color are psychological in nature, being defined solely in terms of reaction, and without essential reference to the stimulus.

In this report *lightness* and *value* will be employed as synonyms for *brilliance*, as these were used by Munsell (8) to denote an identical psychological concept, and are so used by the Munsell Color Company, from which the colored rectangles were obtained.

The hue series was designed to include the four psychological primary hues; red, yellow, blue, and green. These, when paired, make up a hue series containing six pairs of hues equated in the Munsell system for lightness and saturation.

The lightness and saturation series were designed to include four sub-series each, corresponding to the four psychological primary hues. Within each sub-series three colors were selected for comparison. These were to represent *high*, *low* and *medial* points along the lightness and saturation dimensions. The colors selected, however, do not represent the highest or lowest lightnesses or saturations created by the Munsell Color Company, for their selection was a function not only of the considerations already described but also of the following: *optimal experimental design required that the colors in each of the four sub-series comprising the lightness series resemble each other as closely as possible with respect to saturation, and that the colors in each of the four sub-series comprising the saturation series resemble each other as closely as possible with respect to lightness, so that the findings derived from each sub-series might be maximally comparable with those of the other three within the series.*

> It is desired at this point to digress long enough to introduce Table 1, in which a schema is presented embodying the three series, the eight sub-series, the three *points* within each sub-series, and the Munsell specifications for all colors involved. In this and in subsequent tables the following convention will be observed: the colors comprising the color-pair will be separated by a diagonal line. Whenever a proportion is presented in reference to a pair of colors thus separated, it will be meant to describe the proportion of times the color above the diagonal line was preferred to the color below the line. The Munsell specification involves a fraction placed alongside each hue, whose numerator designates the lightness, or *value*, and whose denominator indicates the degree of saturation, or *chroma*. The value is specified along an eleven-point scale in which *zero* and *ten* represent black and white respectively, and intervening values denote corresponding shades of gray. The chroma scale extends from zero, which denotes gray, to maxima that are functions of the specific hues involved. Zero chroma is referred to in the Munsell system as *neutral*, or *N*.

Returning, now, to the discussion of the choice of colors for each of the sub-series, an inspection of Table 1 reveals that the condition of maximal similarity with respect to saturation was met in the lightness series through selection of

TABLE 1

ORGANIZATION AND MUNSELL SPECIFICATION OF THE COLORS COMPRISING THE HUE, LIGHTNESS, AND SATURATION SERIES

Series	Hue Involved	Color Pair	Munsell Specification of Color Above the Diagonal	Munsell Specification of Color Below the Diagonal
Hue Series		R /B	Red 5/6	Blue 5/6
		R /G	Red 5/6	Green 5/6
		R /Y	Red 5/6	Yellow 5/6
		Y /B	Yellow 5/6	Blue 5/6
		Y /G	Yellow 5/6	Green 5/6
		B /G	Blue 5/6	Green 5/6
Lightness Series	R	H /L	Red 8/2	Red 2/2
		H /M	Red 8/2	Red 5/2
		M/L	Red 5/2	Red 2/2
	Y	H /L	Yellow 8/2	Yellow 2/2
		H /M	Yellow 8/2	Yellow 5/2
		M/L	Yellow 5/2	Yellow 2/2
	B	H /L	Blue 8/2	Blue 2/2
		H /M	Blue 8/2	Blue 5/2
		M/L	Blue 5/2	Blue 2/2
	G	H /L	Green 8/2	Green 2/2
		H /M	Green 8/2	Green 5/2
		M/L	Green 5/2	Green 2/2
Saturation Series	R	H /L	Red 4/14	Neutral 4
		H /M	Red 4/14	Red 4/6
		M/L	Red 4/6	Neutral 4
	Y	H /L	Yellow 8/12	Neutral 8
		H /M	Yellow 8/12	Yellow 8/6
		M/L	Yellow 8/6	Neutral 8
	B	H /L	Blue 4/8	Neutral 4
		H /M	Blue 4/8	Blue 4/4
		M/L	Blue 4/4	Neutral 4
	G	H /L	Green 5/8	Neutral 5
		H /M	Green 5/8	Green 5/4
		M/L	Green 5/4	Neutral 4

colors whose chroma was uniformly 2 in the Munsell system. The uniformity with respect to lightness in the saturation series, however, was not met as rigorously because coated papers covering maximal saturation ranges in all lightnesses do not exist. Colors were finally selected, therefore, that represented compromises between adherence to the condition of maximal saturation range and that of maximal similarity of colors within the saturation series with respect to lightness.

The following directions were given orally:

I am going to show you two colors. (Demonstrate) If you like the one on this side less, you turn it out, like this. (Demonstrate) If you like the one on this side less, you turn it out, like this. (Demonstrate) Now, turn out the one you like less.

The instructions were repeated as often as the investigator believed necessary for maintenance of an adequate set. No time limit was imposed. The

entire test was taken at one sitting of approximately twenty minutes.

It was believed more efficacious to employ a task in which the subject avoided the color he liked *less,* rather than the more conventional one in which the color preferred is indicated. The first method allows the subject, who in this experiment was likely to be disturbed and extremely negativistic, to do something for *himself,* that is, to remove from his visual field that color which is less pleasing to him. This *avoidance* type of reaction was believed, therefore, to be more conducive to success with the negativistic catatonic and with the hostile manic patients. One might question the degree to which the preference findings derived from this procedure might be comparable to those resulting from experiments in which the color preferred was indicated. In this regard, reference is made to a study by Fernberger (3), in which subjects were asked to indicate the colors they preferred, and also those they disliked, of colors presented by the method of paired comparisons; and it was concluded that the difference between the procedures involved was not of material effect.

Each color-pair was presented four times. In order to offset positional effects, the cards on which the color-pairs were mounted were rotated through 180 degrees after each series of presentations. The colors were so ordered that no color followed itself. The influence of temporal position in the series was minimized by placing the card first in the series when testing one subject in the last place when testing the subject next in line.

CHAPTER III

SUBJECTS

THE four psychiatric groups whose color preferences were explored in this investigation were patients diagnosed as being anxiety neurotics, catatonic schizophrenics, and patients in the manic and the depressed phases of manic-depressive psychosis.

These four psychiatric groups were selected for study because they were believed to contain individuals representing extremes with respect to the affect-related qualities of anxiety, withdrawal, mania, and depression, respectively. It was believed likely, therefore, that exploration pertaining to these psychiatric groups might be of value in suggesting hypotheses to investigators concerned with affectivity.

Psychiatric diagnosis was the necessary basis for inclusion into one of these groups. Supplementing this were a number of restrictive conditions designed to increase the representativeness of the samples. One was that no patient was included who had experienced a convulsive or coma type of treatment during the period of thirty days prior to the time of testing. Another was the exclusion of all cases of prefrontal lobotomy. A third was that no patient was included, who, in the investigator's opinion, did not present symptoms reasonably similar to the text-book features of the particular disturbance. The need for using this latter criterion occurred only with the manic-depressives, where considerable change in mood since the time of diagnosis was not uncommon. The fourth excluding condition was evidence of substantial disagreement among psychiatrists as to diagnosis.

The schizophrenics numbered 120 while the other three groups numbered 60 each. The two sexes were equally represented in all four groups.

In order to lessen the effects of diagnostic trends peculiar to one hospital or clinic, the control was observed that not more than half of any diagnostic group was drawn from any single installation.

Since individuals falling within the psychiatric classification of catatonic schizophrena may commonly present either of two widely separated groups of symptoms, an attempt was made to have these two groups equally represented. Accordingly, the 120 catatonics are composed of two groups of 60, one of which is termed *active*, and the other *passive*. In each of these the sexes are equally represented. Two sources of information were employed by the investigator in assigning catatonics to each of these categories: behavior during the testing situation, and the case history. The data of these sources were judged in terms of whether the individual displayed negativism directed toward the outer world, or appeared to direct it toward himself; with manifestations on the one hand in assaultism and related symptoms, and on the other in mutism and similar signs. Accordingly, if the subject's case history gave evidence of extreme inaccessibility during the acute attack at the time of hospitalization and during subsequent hospitalization, together wth symptoms such as underactivity and passivity during the test, the patient was placed into the passive group. If, on the other hand, marked overactivity and outwardly directed hostility are recorded as characterizing the onset and course of the disease, and the behavior during the testing period gave evidence of outwardly directed hostility, the subject was classified as active. It was noted that the patients generally displayed a mixture of the active and passive features, particularly when the case history extended over a period of many years. The subjects tested generally fell far short of pure types. However, an attempt was made to select those in which a predominance of one or the other set of symptoms appeared to be in evidence.

The color preferences of these two groups of catatonics were compared, and yielded no significant differences, the highest critical ratio found in the thirty comparisons being only 1.48.

This would tend to indicate that the marked behavioral differences between these two groups are not associated with differences in color preferences.

A factor for which no provision was made in the selection of subjects is that of color-blindness. Two sorts of implications of such an omission come to mind. The first relates to congenital color-blindness; the second to the possibly altered incidence of color-blindness among certain psychiatric groups. Both of these implications will be discussed in section IV, B, 6, in the light of the findings of this investigation.

Control was not established for the age factor. The average ages of the psychiatric groups differed markedly, but the average ages of the sexes within each psychiatric group corresponded fairly closely. The mean ages for the male manic, depressed, catatonic, and anxiety neurotic subjects were 51.9, 56.2, 31.5, and 32.5 respectively; while those of the corresponding females were 46.8, 48.3, 31.2, and 40.1. These mean ages are consistent with observations made by psychiatrists (9) of the peak ages at which representatives of these psychiatric groups are seen in hospitals and clinics. These facts bear upon the desirability of selecting only those patients who fall within a specified age range, for such a procedure may well impair the representativeness of the samples. Reference will be made to these age differences when the findings of this investigation are discussed.

Two relevant variables for which provisions were not made are *length of hospitalization* and *progress of the disease.* By the latter is meant the quality generally described in terms of *acute, chronic,* or *deteriorated.* These factors are considered important, and it is regretted that practical considerations did not permit the observance of related controls.

CHAPTER IV

RESULTS

THE results of this investigation will be presented and discussed in three sections. The first will deal with evidence of the reliability of the observed color preferences. The second and third will deal respectively with differences between the color preferences of psychiatric and sex groupings.

A. Evidence of the Reliability of Color Preferences

The question of the reliability of color preferences will be treated in two ways. First we shall consider the individual subject: his consistency from trial to trial. Next, we shall treat the color preferences of *groups* of subjects.

As to the first of these, since each color-pair is presented four times, the per cent agreement among these trials is readily determined. An average was taken of the per cent agreement in each of the 9,000 sets of four trials contained in the data, which was equal to 81.5. This figure is 59.8 times as large as the standard error of the theoretically expected per cent agreement of 50, and strongly indicates that the consistency from trial to trial cannot be explained in terms of chance.[1]

The second method involves a consideration of the preferences indicated by various *groups* of individuals. Here we inquire into the likelihood that the proportion of choice observed for the group might be due simply to chance. The method employed was to compute the deviation of an observed proportion of choice from the theoretically expected proportion of .5; to compute the standard error of the theoretically expected proportion of choice by means of the formula described in footnote 1 of this section; and to obtain the quotient of this deviation divided by this standard error. If the value of such a quotient is equal to or greater than 1.96 the chances are less than 5 in 100, while if equal to or greater than 2.58 the chances are less than 1 in 100 that a deviation as great as that found between the observed proportion and that most likely to be observed on the basis of chance would be observed if chance alone determined the proportions reported. The four psychiatric groups and the two sex groups thus considered yielded a total of 180 individual deviations in terms of such standard error units, of which 127 were greater than 2 and 89 surpassed 3. These frequencies indicate the very slight probability that proportions such as those observed could have been obtained without determination by some factor or factors additional to chance.

B. Comparison of the Color Preferences of Psychiatric Groups

In the studies of Shikiba (10) and Katz (7), the color preferences of psychiatric groups were explored in the dimension of hue alone. Dorcus (1) attempted to study the effect of saturation by constructing two hue series, in one

[1] The standard errors of proportions were computed as being equal to the square root of pq divided by the square root of N; in which p and q represent decimal fractions whose sum is unity, and N designates the number of sample items involved. The square root of pq for every value of p was obtained directly from tables prepared by Holzinger (4). The number of items entering into the above problem was taken to be 9,000. All numbers of items employed in computations yielding measures of error cited elsewhere in this report are presented in each table listing such measures.

of which the color pairs were equated for lightness and saturation in the Munsell system; while the other was composed of paired colors differing in hue and of maximal saturation, regardless of lightness specifications.

As was described in an earlier section, the present investigation was designed to allow the study of all three psychological dimensions for relatedness to psychiatric groupings. Related findings will be presented first according to the series in which they occur, following which, they will be discussed in relation to findings within other series.

1. *Findings within the Hue Series*

Tables 2, 3, and 4 refer respectively to the comparison of the manics and the anxiety neurotics, the depressed and the

TABLE 2

COMPARISON OF THE COLOR PREFERENCES OF THE ANXIETY NEUROTIC AND MANIC GROUPS

Series	Hue Involved	Color Pair	Proportion of Times Color Above Diagonal Was Preferred		Difference	C.R.
			Anxiety Neurotic (60)	Manic (60)		
Hue Series		R /B	.354	.392	−.038	0.43
		R /G	.458	.425	+.033	0.36
		R /Y	.758	.733	+.025	0.31
		Y /B	.167	.225	−.058	0.80
		Y /G	.121	.267	−.146	2.06
		B /G	.708	.663	+.045	0.53
Lightness Series	R	H /L	.717	.638	+.079	0.93
		H /M	.700	.646	+.054	0.63
		M/L	.663	.554	+.109	1.23
	Y	H /L	.833	.721	+.112	1.49
		H /M	.892	.804	+.088	1.35
		M/L	.754	.583	+.171	2.02
	B	H /L	.737	.621	+.116	1.37
		H /M	.675	.654	+.021	0.24
		M/L	.775	.650	+.125	1.53
	G	H /L	.700	.663	+.037	0.43
		H /M	.646	.650	−.004	0.05
		M/L	.692	.630	+.062	0.72
Saturation Series	R	H /L	.592	.554	+.038	0.42
		H /M	.608	.550	+.058	0.64
		M/L	.646	.629	+.017	0.19
	Y	H /L	.433	.363	+.070	0.78
		H /M	.413	.454	−.041	0.45
		M/L	.521	.425	+.096	1.06
	B	H /L	.729	.725	+.004	0.05
		H /M	.579	.562	+.017	0.19
		M/L	.838	.783	+.055	0.77
	G	H /L	.671	.629	+.042	0.48
		H /M	.558	.538	+.020	0.22
		M/L	.738	.675	+.063	0.76

TABLE 4

COMPARISON OF THE COLOR PREFERENCES OF THE ANXIETY NEUROTIC AND CATATONIC GROUPS

Series	Hue Involved	Color Pair	Proportion of Times Color Above Diagonal Was Preferred		Difference	C.R.
			Anxiety Neurotic (60)	Catatonic (120)		
Hue Series		R /B	.354	.369	−.015	0.20
		R /G	.458	.440	+.018	0.23
		R /Y	.758	.731	+.024	0.40
		Y /B	.167	.246	−.079	1.27
		Y /G	.121	.256	−.135	2.34
		B /G	.708	.657	+.051	0.70
Lightness Series	R	H /L	.717	.654	+.063	0.87
		H /M	.700	.642	+.058	0.79
		M/L	.663	.500	+.163	2.14
	Y	H /L	.833	.704	+.129	2.03
		H /M	.892	.781	+.111	2.02
		M/L	.754	.567	+.187	2.61
	B	H /L	.737	.665	+.072	1.01
		H /M	.675	.607	+.068	0.91
		M/L	.775	.611	+.164	2.35
	G	H /L	.700	.640	+.060	0.81
		H /M	.646	.648	−.002	0.03
		M/L	.692	.557	+.135	1.80
Saturation Series	R	H /L	.592	.613	−.021	0.27
		H /M	.608	.586	+.022	0.28
		M/L	.646	.632	+.014	0.18
	Y	H /L	.433	.471	−.038	0.48
		H /M	.413	.527	−.144	1.46
		M/L	.521	.459	+.062	0.79
	B	H /L	.729	.725	+.004	0.06
		H /M	.579	.642	−.063	0.82
		M/L	.838	.751	+.087	1.41
	G	H /L	.671	.671	.000	0.00
		H /M	.558	.548	+.010	0.13
		M/L	.738	.713	+.025	0.36

higher are found. Such differences are found twice: once in the comparison of the anxiety neurotics and the catatonics, and again in the comparison of the anxiety neurotics and the manics. The third highest critical ratio, 1.74, also involves the group of anxiety neurotics, and occurs when these are compared with the depressed.

When these comparisons are examined for consistency of direction, the anxiety neurotics are seen to prefer the green to the yellow more strongly in each of the three corresponding comparisons.

2. *Findings within the Lightness Series*

Inspection of corresponding portions of Tables 2, 3, and 4 reveals that in this series seven critical ratios of 2 or more are found; and that these occur, as in the

anxiety neurotics, and the catatonics and the anxiety neurotics. Corresponding tables covering the comparison of the manics and the depressed, the manics and the catatonics, and the depressed and the catatonics have been omitted for reasons of economy as these did not contain a single critical ratio equal to or greater than 2.[2]

An examination of Tables 2, 3, and 4 reveals that of the entire hue series *Y/G* is the only color-pair with respect to which differences between the psychiatric groups yielding critical ratios of 2 or

[2] All standard errors of differences between proportions were computed as being equal to the square root of the sum of the squares of the standard errors of the individual proportions involved. The computation of the standard errors of these individual proportions was described in the footnote of section IV, A.

TABLE 3

COMPARISON OF THE COLOR PREFERENCES OF THE ANXIETY NEUROTIC AND DEPRESSED GROUPS

Series	Hue Involved	Color Pair	Proportion of Times Color Above Diagonal Was Preferred		Difference	C.R.
			Anxiety Neurotic (60)	Depressed (60)		
Hue Series		R /B	.354	.296	+.058	0.68
		R /G	.458	.525	−.067	0.74
		R /Y	.758	.700	+.058	0.72
		Y /B	.167	.158	+.009	0.13
		Y /G	.121	.242	−.121	1.74
		B /G	.708	.742	−.034	0.42
Lightness Series	R	H /L	.717	.688	+.029	0.35
		H /M	.700	.625	+.075	0.87
		M/L	.663	.650	+.013	0.15
	Y	H /L	.833	.808	+.025	0.36
		H /M	.892	.863	+.029	0.49
		M/L	.754	.583	+.171	2.02
	B	H /L	.737	.700	+.037	0.45
		H /M	.675	.675	.000	0.00
		M/L	.775	.725	+.050	0.63
	G	H /L	.700	.742	−.042	0.51
		H /M	.646	.625	+.021	0.24
		M/L	.692	.700	−.008	0.10
Saturation Series	R	H /L	.592	.563	+.029	0.32
		H /M	.608	.471	+.137	1.52
		M/L	.646	.688	−.042	0.49
	Y	H /L	.433	.367	+.066	0.74
		H /M	.413	.375	+.038	0.43
		M/L	.521	.429	+.092	1.01
	B	H /L	.729	.746	−.017	0.21
		H /M	.579	.567	+.012	0.13
		M/L	.838	.846	−.008	0.12
	G	H /L	.671	.613	+.058	0.66
		H /M	.558	.504	+.054	0.59
		M/L	.738	.721	+.017	0.21

hue series, in those comparisons involving the anxiety neurotics. Also, as in the hue series, the directions of these differences are the same in all seven cases, indicating consistently a greater preference for the lighter colors among the anxiety neurotics.

When the twelve lightness scores in each of the three comparisons involving the anxiety neurotics (Tables 2, 3, 4, and Figure 1) are examined for the consistency of the direction of differences, it is found that in four comparisons the anxiety neurotics preferred the lighter color less strongly than did the other groups; in one comparison no difference was found; and in thirty-one comparisons the lighter color was preferred more strongly by the anxiety neurotic group. The magnitude of the difference in none of those four comparisons in which the lighter color was preferred less strongly by the anxiety neurotics approached a critical ratio of 2; while, as was stated earlier, this level was surpassed in seven pairs in which this group preferred the lighter color more strongly, and was approached in several additional pairs.

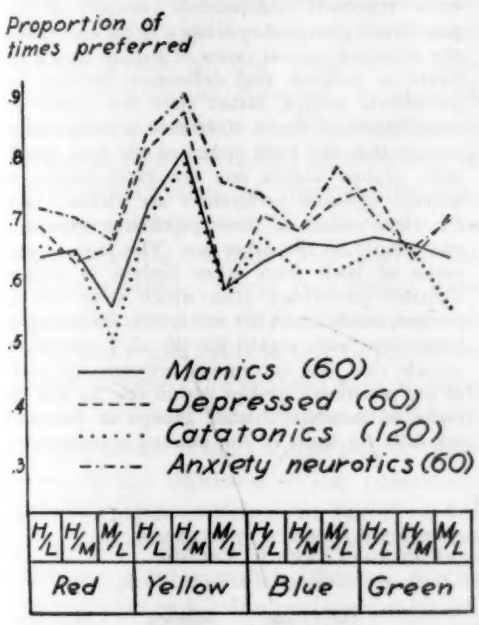

FIG. 1. Comparison of the proportions of times the lighter colors were preferred to the darker colors by each psychiatric group in the comparisons comprising the lightness series.

3. *Findings within the Saturation Series*

None of the seventy-two comparisons of this series (listed in the six tables described in section IV, B, 1) yielded a critical ratio as great as 2. One comparison, that of the *H/M* pair of the yellow sub-series in the comparison of the depressed and the catatonics, resulted in a critical ratio of 1.98. This is, of course, statistically significant at slightly better than the 5 per cent level. However, on the basis of chance alone we would expect three critical ratios of this size among the seventy-two comparisons. In the absence of corroborative evidence, it remains to be demonstrated that the single critical ratio of 1.98 is indicative of the operation of any factor other than chance.

4. *Comparison of the Parallels*

Thus far, evidence has been presented indicating that some psychiatric groups differ significantly with respect to the *Y/G* pair of the hue series and with respect to the color-pairs of the lightness series. Since it is desired to discuss these two types of color-pairs at some length, the term *parallel* will be used to denote either of these types.

These parallels have been seen to have similar effects on the following grounds:

1. All of the nine critical ratios of 2 or greater occurred in color-pairs comprising these parallels.

2. Each parallel yielded a critical ratio of 2 or greater only when the anxiety neurotics were involved in a comparison.

3. The direction of difference in each of the comparisons yielding a critical ratio of 2 or greater was consistent for each parallel. This direction was toward a greater preference for green to yellow and a greater lightness preference among the anxiety neurotics.

In order to explore more fully the similarity between the differentiating effects of these two parallels, an attempt was made to obtain a measure of the central tendency of all the scores of the lightness series by computing the mean of all twelve proportions of choice in the lightness series of each psychiatric group. These means, together with the average proportion of choice of each psychiatric group with respect to the *G/Y* pair are presented in Table 5. Three comparisons are made: the first involves total psychiatric groups, while the second and third relate to the comparison of representatives of each sex within each psychiatric category. Inspection of these sources reveals that the anxiety neurotics, as a group, occupy the same extreme rank with respect to both parallels, and that second place is likewise held consistently by the depressed. The manics and the schizophrenics, when likewise considered as total groups, change in rank order, but the difference between the proportions of choice displayed by these groups is relatively small.

In examining the data of Table 5 we have an opportunity to see whether the relationships observed betwen the psychiatric categories and the two parallels hold for each sex. Since the sexes represent independent samples of the psychiatric groups they allow a check on whether the obtained critical ratios of higher than 2 are likely to indicate real differences between the psychiatric groups, rather than the chance accumulations of scores. Reference to these sources reveals that the rank orders of the four psychiatric groups within one sex (with respect to average lightness preference) are identical with the rank orders of these psychiatric groups in the sample of the other sex. The anxiety neurotics of both sexes score highest in average lightness preference, after which come the depressed, manics, and the catatonics. An analogous inspection with regard to the *G/Y* preference reveals that the agreement between the ranks of the psychiatric groups within one sex and the ranks of these psychiatric groups in the other sex falls far short of the marked agreement ex-

TABLE 5

COMPARISON OF THE PSYCHIATRIC GROUPS WITH RESPECT TO AVERAGE LIGHTNESS PREFERENCE AND PREFERENCE FOR GREEN TO YELLOW

Color Pairs	Portion of the Group	Anxiety Neurotics (60)	Depressed (60)*	Manics (60)	Catatonics (120)
Average proportion of times the lighter color was preferred in the twelve color-pairs comprising the lightness series	Male	.719	.671	.617	.602
	Female	.745	.726	.685	.661
	Total	.732	.699	.651	.632
Proportion of times green was preferred to yellow	Male	.883	.892	.867	.792
	Female	.875	.625	.600	.696
	Total	.879	.759	.734	.744
Rank order of the average proportion of times the lighter color was preferred in the twelve color-pairs comprising the lightness series	Male	1	2	3	4
	Female	1	2	3	4
	Total	1	2	3	4
Rank order of the proportion of times green was preferred to yellow	Male	2	1	3	4
	Female	1	3	4	2
	Total	1	2	4	3

hibited with respect to average lightness preference. Accordingly, the critical ratios greater than 2 that were obtained in relation to the *G/Y* pairs are believed less likely to reflect the operation of factors additional to chance than are those obtained in connection with the color-pairs of the lightness series.

The reader will note that only nine critical ratios in excess of 2 emerged from the 180 comparisons, and that such a number is but slightly greater than what we might expect on the basis of chance. The significance of these nine critical ratios is not considered substantially lessened, however, in view of the fact that *all nine* of the critical ratios in excess of 2 are found in only *two* of the various classes of observations—viz., those involving the *Y/G* pair of the hue series, and the various color-pairs of the lightness series. (These two classes have been described in this section as *parallels.*) The remarkable degree of similarity shown between the parallel data relating to one sex and that of the other (particularly with respect to the twelve color-pairs of the lightness series) constitutes corroborative evidence in favor of the thesis that these nine critical ratios do indicate a relationship between psychiatric status and color preferences.

5. *Comparison of the Findings with Those of Prior Investigations in This Area*

Some marked discrepancies exist between the findings of Shikiba (10) and Katz (7) and those of the present investigation. Shikiba reported that his sample of manics ranked red first in order of preference to violet, green, blue, orange, and yellow, while the depressed group ranked red last. In view of this it is surprising that Katz found red to be more pleasing to a combined group of manic-depressives than to either his schizophrenic or his combined group. The findings of this investigation are consistent with neither of the above, for, as was reported earlier, the pairs of the hue series that contained red did not differentiate between the psychiatric groups to degrees that could not be explained in terms of chance.

The reasons for these discrepancies may perhaps be found in a number of differences between these studies. In the first place, Shikiba (10) did not provide for equal representation of the sexes, and since Katz (7) does not mention this control it is reasonable to infer that he also did not provide for it; while the present investigation offers evidence of the importance of this factor. Then, again, the lightness and saturation specifications of the hues employed in both prior studies differed from each other other as well as from those employed in the present investigation; and the present study as well as a number of previous ones indicate that hedonic tone is a function of both lightness and saturation. Furthermore, Shikiba's study contained considerably fewer subjects in samples of the manics and the depressed, and although figures are lacking we may infer that the same was true of Katz's samples. Consequently, both studies do not include estimates of the probable errors of differences observed. Lastly, both previous studies involved the method of choice, while that of paired comparisons was employed here. To these elements of difference might be added a number of others, but those already listed are believed sufficient to indicate that no strict comparison of the findings is permissible.

For purposes of completeness it is desired to mention a study by Dorcus (1) in which the color preferences of a psychiatrically undifferentiated group of nineteen male and forty-eight female psychiatric patients, determined through the use of Munsell colors, were compared with those of several non-psychiatric groups of considerably larger size; and yielded negative related findings. It is recognized that the desirability of including this study in the present discussion is questionable since it deals with the comparing of psychiatric and non-psychiatric groups rather than the

comparison of specified psychiatric categories. However, elements of similarity in the natures of the areas investigated are believed sufficiently pronounced to warrant its inclusion. As to possible reasons why Dorcus' findings were negative while the present investigation yielded positive findings in the lightness and hue series, two obvious ones suggest themselves. In the first place, Dorcus did not employ a lightness series, and thereby precluded the possibility of findings in this area. Second, it will be remembered that positive findings resulted from the comparison of the anxiety neurotics and those patients who had adopted various adjustments that tended to forestall the experiencing of anxiety —particularly the schizophrenics. One may speculate that by combining his unclassified psychiatric patients, Dorcus obtained, in effect, a group that was highly heterogeneous with respect to anxiety experienced, so that the psychiatric group *as a whole* approached the anxiety level of non-psychiatric populations.

6. *Discussion of the Likelihood That Findings in This Area Are Due to the Effects of Two Uncontrolled Variables*

a. *The age factor.* The very considerable differences observed between the mean ages of the psychiatric groups raises the question of the degree to which such age differences might be responsible for the differences between the color preferences of the psychiatric groups already noted.

The laborious task of tabulating the 36,000 scores comprising the data, especially when the nature of the data does not allow a definitive study in this area, contraindicates the use of defined statistical techniques in connection with this discussion. However, this question may be treated crudely through a consideration of the degree of concomitance existing between variance along the following two dimensions: the difference between the mean ages of the psychiatric groups, and the extent to which differences between the psychiatric groups were noted with respect to the two parallels. The four combinations resulting when the extremes of one dimension are combined with those of the other are: two groups that differ markedly in average age, and differ significantly with respect to parallel preferences; two groups that differ markedly in average age, but do not differ significantly with respect to parallel preferences; two groups that do not differ markedly in average age, and do differ significantly with respect to parallel preferences; two groups that do not differ markedly in average age, and do not differ significantly with respect to parallel preferences. If a strong relationship were to exist between age differences and differences in color preferences, then, two of the preceding four possibilities would probably be found in the existing data. As things stand, however, all four possibilities are to be found, respectively, in the following comparisons: manic-anxiety neurotic, manic-catatonic, catatonic-anxiety neurotic, and manic-depressed. While this treatment allows no more than an approximation, it does appear to indicate that if a relationship exists between age and parallel preference, the effect of this factor is not likely to be of a magnitude sufficient to acount for the statistically significant differences observed between certain of the psychiatric groups.

b. *The factor of color-blindness.* It

will be recalled that two implications of the neglect of this factor were mentioned in an earlier section: the effects of so-called *congenital* color-blindness, and the influence of psychiatric states upon the incidence of color-blindness.

As to the first of these, it is of relevance to note that extensive investigations (5) have revealed the incidence of congenital color-blindness in the population to approximate 8 per cent among the males, and 0.5 per cent among the females. The probability that percentages of these magnitudes, particularly in the case of the females, could result in the selection of psychiatric samples disproportionately represented by the color-blind to the extent of effecting critical ratios of the sizes reported in this paper—is considered to be remote.

The second of these implications is included for discussion because it lends itself to the impression that it has a bearing upon the scope of the problem investigated. There is some suggestive evidence in the literature to the effect that the neurotics (2), the manics, and the schizophrenics (6) include a higher proportion of the color-blind than the non-psychiatric population. The question arises as to the degree to which the conclusions of this study may be invalidated if an intrinsic characteristic of these psychiatric groups is truly a higher incidence of color-blindness. The answer to this question is, obviously, that this factor has no bearing whatsoever. The conclusions of this study will describe concomitant variation, not causation. The validity of a description of concomitance is surely independent of all considerations pertaining to whether or not specific factors (intrinsic to the categories under consideration) entered into the etiology of such concomitance.

C. Comparison of the Color Preferences of the Sexes

It is not a major purpose of this investigation to explore sex differences in color preferences. This area is treated primarily because it bears upon the need for controlling this factor in investigations of color preferences.

Since equal representation was given each sex in each of the psychiatric groups, total sex groups of 150 subjects each exist, and their comparison is summarized in Table 6. Findings resulting from this comparison will now be presented according to the series in which they occur, following which, a number of relationships transcending single series will be presented.

1. *Findings within the Hue Series*

Inspection of Table 6 reveals that in all four related comparisons the males preferred the *cool* hues (blue, green) to the *warm* hues (red, yellow) to greater extents than did the females. The magnitudes of such differences are such that in three of the four comparisons the differences are statistically significant at better than the 1 per cent level, while in the fourth comparison (*Y/B*) a difference as large as that observed would probably be arrived at by chance in only eight out of one hundred trials.

Since each of the four psychiatric groups contains an independent sample of each sex, an additional index of the reliability of the differences observed between the sexes is afforded by an inspection of the degree of consistency existing among the sex differences derived from the several psychiatric groups. For purposes of economy, the table listing the proportions corresponding to the color preferences of each sex sub-group within each psychiatric group has not been included in this report. However, summaries of its data will be included at points in the discussion. In this connection, it was found by inspection that of the sixteen pairs of sub-scores in which a cool and a warm hue were

TABLE 6
SEX DIFFERENCES IN COLOR PREFERENCES

Series	Hue Involved	Color Pair	Proportion of Times Color Above Diagonal Was Preferred		Difference	C.R.
			Males (150)	Females (150)		
Hue Series		R /B	.243	.468	−.225	4.17
		R /G	.342	.573	−.231	4.09
		R /Y	.697	.765	−.068	1.31
		Y /B	.167	.250	−.083	1.77
		Y /G	.155	.302	−.147	3.04
		B /G	.707	.663	+.044	0.82
Lightness Series	R	H /L	.638	.702	−.064	1.19
		H /M	.715	.587	+.128	2.35
		M/L	.485	.662	−.177	3.13
	Y	H /L	.700	.808	−.108	2.17
		H /M	.805	.843	−.038	0.87
		M/L	.543	.678	−.135	2.41
	B	H /L	.662	.693	−.031	0.57
		H /M	.688	.598	+.090	1.63
		M/L	.580	.768	−.188	3.53
	G	H /L	.620	.733	−.113	2.10
		H /M	.703	.583	+.120	2.20
		M/L	.563	.690	−.127	2.27
Saturation Series	R	H /L	.593	.580	+.013	0.23
		H /M	.630	.490	+.140	2.44
		M/L	.548	.742	−.194	3.55
	Y	H /L	.428	.413	+.015	0.26
		H /M	.500	.418	+.082	1.43
		M/L	.395	.522	−.127	2.22
	B	H /L	.783	.577	+.106	2.08
		H /M	.687	.510	+.177	3.17
		M/L	.767	.820	−.053	1.13
	G	H /L	.695	.607	+.088	1.59
		H /M	.628	.450	+.178	3.11
		M/L	.682	.742	−.060	1.15

paired, the direction of preference described in the preceding paragraph was maintained in fifteen of the pairs, while a tie existed in the sixteenth.

That the warm-cool dichotomy between hues is meaningful is given added credence by the finding that in those two color-pairs (Table 6) in which two warm and two cool hues are paired, the differences between the preferences displayed by the sexes do not approach the 5 per cent level of significance, yielding critical ratios of 1.31 and 0.82.

The following statement appears to summarize sex differences in the hue series: the males tend to prefer the cool hues to the warm hues to a greater extent than do the females.

2. *Findings within the Lightness Series*

Sex differences in the lightness and saturation series will be presented briefly in this section and in the one immedi-

ately following. These differences will be treated more fully in subsequent organizations relating groups of color-pairs belonging to both of these series.

Inspection of the lightness series of Table 6 reveals that of the four *H/L* pairs the females preferred the *H* to a greater extent in all four pairs, of which two yielded critical ratios above 2; of the four *H/M* pairs the males preferred the *H* to a greater extent in three of the four pairs, of which two yielded critical ratios above 2; and of the four *M/L* pairs the females preferred the *M* to a greater extent than did the males in all four pairs, of which all four yielded critical ratios above 2.

An examination of the sex sub-groups within each of the psychiatric groups for the degree to which these directions of difference were maintained in the separate sex samples of each psychiatric group reveals that the *H/L* trend was maintained in fourteen of the sixteen related pairs of sub-scores, the *H/M* trend in twelve of the sixteen, and the *M/L* trend in all sixteen.

3. *Findings within the Saturation Series*

The saturation series of Table 6 reveals that of the four *H/L* pairs the males preferred the *H* to a greater extent in all four pairs, one of which yielded a critical ratio above 2; of the four *H/M* pairs the males preferred the *H* to a greater extent in all four pairs, three of which yielded critical ratios greater than 2; of the four *M/L* pairs the females preferred the *M* to a greater extent than the males in all four pairs, of which two yielded critical ratios above 2.

When an inspection is made of the sex sub-groups within each of the psychiatric groups for the degree to which these trends are maintained among the independent sex samples of the psychiatric groups, it is found that the *H/L* trend is maintained in eleven of the sixteen related pairs of sub-scores; the *H/M* in fifteen of the sixteen; and the *M/L* in twelve of the sixteen, along with one tie.

4. *Sex Differences with Respect to Color-Pairs Involving a Medial and an Extreme Color in Both the Lightness and Saturation Series*

In view of the findings described in the preceding two sections, an organization of those color-pairs in which a color that is extreme along either the lightness or the saturation dimension is paired with one more medial on the same dimension promises the emergence of meaningful relationships. Since there are four *H/M* and four *M/L* color-pairs in each series, a total of sixteen color-pairs relate to this organization.

Inspection of Table 6 reveals that in fifteen of the sixteen related pairs, the direction of the differences between the sexes is toward a higher preference for the extreme color among the males; and that the magnitudes of these differences are such that statistical significance at better than the 5 per cent level is found in eleven of these fifteen pairs. The single exception to the direction of the trend observed is small and yields a critical ratio of only 0.87.

That data of this degree of consistency, involving critical ratios of these sizes, should be obtained when the sexes are compared with respect to preference for the extreme to the medial colors, appears the more remarkable in view of the fact that two different extremes, eight different sub-series, four different hues, two distinct series, and four psychiatric groups are involved.

When an inspection is made of the sex sub-groups within each of the psychiatric groups for the degree to which this *medial-extreme* trend is manifested among the four independent pairs of sex samples corresponding to the four psychiatric groups, it is found to hold in fifty-five of the sixty-four related pairs; while a tie is found in one.

It is consistent with these findings to conclude that the males tend to prefer the more extreme colors to the more medial colors to a greater extent than do the females, in both the lightness and the saturation series.

5. *Sex Differences with Respect to Color-Pairs Involving a High-Point and a Low-Point in Both the Lightness and Saturation Series*

An inspection of that portion of Table 6 that relates to the H/L pairs of the lightness series reveals that in all four color-pairs the females prefer the lighter color to the darker to a greater extent than do the males, and that the magnitudes of these differences provide statistical significance at better than the 5 per cent level in two of the four pairs. The independent samples of each sex contained within each of the psychiatric groups display this trend in fourteen of the sixteen related sets of sub-scores.

In examining that portion of Table 6 that relates to the H/L pairs of the saturation series, we find that a reversal of the condition met in the lightness series is true consistently in all four related pairs. In these the males prefer the more saturated colors to a greater extent than do the females. Related portions of Table 6 show that one such difference is significant at better than the 5 per cent level. This trend is maintained by the four independent samples of each sex in eleven of the sixteen related pairs of sub-scores.

It is consistent with these findings to conclude that the females tend to prefer the high extreme color to the low extreme color in the lightness series to a greater extent than do the males, while the reverse is true in the saturation series.

CHAPTER V

SUMMARY AND CONCLUSIONS

A REVIEW of prior investigations of the relationships between color preferences and psychiatric groupings indicated the need for further study on the following two grounds: the sampling techniques employed were faulty; and no adequate bases existed for determining which of the three psychological dimensions of color (hue, lightness, or saturation) were related to such differences between psychiatric groups as were observed.

In view of the first of these inadequacies, a number of sampling precautions were observed in the present study. The number of subjects in each diagnostic category investigated was made sufficiently large so as to allow the computation of measures of the probable magnitudes of the errors of the statistics that were employed. Accordingly, sixty patients in the manic phase of manic-depressive psychosis, sixty in the depressed phase of this category, sixty anxiety neurotics, and 120 catatonic schizophrenics were tested for color preferences. In each of these psychiatric groups the sexes were equally represented. The catatonic group included equal numbers of patients displaying the so-called *active* and *passive* features. In order to lessen the influence of diagnostic trends peculiar to a particular hospital or clinic the control was observed that no more than half of any psychiatric group was obtained from any single installation. Although controls were not established for the factors of age and color-blindness, evidence has been presented indicating the very slight probability that the statistically significant differences observed between psychiatric groups might be credited to the influence of either of these factors.

An attempt was made to deal with the second inadequacy of prior research through the designing of three color series in each of which one of the psychological dimensions of color was allowed to vary while the other two were kept to constant Munsell specifications. Munsell Standard Papers, in the form of 5 in. by 8 in. rectangles, were presented by the method of paired comparisons under conditions that were carefully controlled with respect to lighting, distances, and *field*. Preferences were indicated in a situation involving an avoidance type of reaction: the patient turned off the light illuminating that member of each color-pair that was less pleasing to him. No time limit was imposed. Instructions were repeated as frequently as appeared necessary for the maintenance of an adequate set.

Each color-pair was presented four times. In order to offset positional, temporal, and sequence factors the following controls were observed, respectively: the color-pairs were rotated through 180 degrees after each series of presentations; the color-pair first in the series when testing one subject was put in the last place when testing the subject next in line; and the colors were so ordered that no color followed itself.

The discussion and conclusions that are to follow will adhere to an organization that is highly similar to that of the findings listed in Chapter IV. This organization of conclusions, rather than the more conventional one of numbering each conclusion consecutively, was adopted because of the following reasons: to describe each conclusion adequately with words would prove verbose; whereas a system of indentations is economical. Specifically, this study constitutes

three color series, two of which contain four sub-series each. Moreover, each color sub-series contains three different *points*, which, when paired, form three color-pairs. It so happens that this study has resulted in conclusions (based upon statistically significant differences) that relate not only to specific color-pairs, to specific sub-series, and to specific series; but also to higher syntheses of these groupings. To present conclusions without adequate description, on the one hand, would prove unintelligible; while to attempt to define verbally the color characteristics of each individual conclusion would surely prove overly wordy and unduly complicated by phraseology. A solution to this dilemma is offered by the system of indentations, since the various series, sub-series, and points fit into a logical scheme; and the color characteristics of a major heading, once stated, are seen at a glance to apply to the sub-headings that are contained.

A. The Reliability of Color Preferences

Tho color preferences of psychiatric patients, as measured in this investigation, are highly reliable. In consequence, the color preferences of those psychiatric groups herein sampled may be considered determinants of behavior of substantial weight; since they produce marked regularity of individual behavior in spite of pronounced emotional disturbance.

B. Comparison of the Color Preferences of Psychiatric Groups

Some psychiatric groups differ significantly from other psychiatric groups with respect to specific color preferences. These specific areas of difference will be described below.

1. *Hue Series*

The anxiety neurotics prefer green to yellow more strongly than do any of the other three psychiatric groups.

2. *Lightness Series*

The anxiety neurotics prefer the lighter colors more strongly than do any of the other three psychiatric groups. That a generalization of this sort (based in part upon a number of critical ratios exceeding 2) should emerge from the data is believed the more significant in view of the following facts: twelve different color-pairs are involved; four distinct hues are represented; and, within each hue the lightness dimension was tapped at three different points—the two extreme positions and a medial point. All these elements of difference enhance the probability that the relationship observed holds not alone for the specific materials employed, but rather holds for the general dimension of lightness.

3. *Saturation Series*

No significant differences between the psychiatric groups were noted in this area.

C. Comparison of the Color Preferences of the Sexes

The sexes differ significantly with respect to color preferences. Statistically significant differences are found in each of the three color series employed in this investigation. A number of generalizations are indicated by the findings and are presented below.

1. *Sex Differences within the Hue Series*

The dichotomy between *warm* hues (red, yellow) and *cool* hues (blue, green) allows an organization of the high critical ratios obtained in this area. *Males tend to prefer the cool hues to the warm hues to a greater extent than do the females.*

2. *Sex Differences within the Lightness Series*

In this series, it will be recalled, we are dealing with three selected points

along a psychological continuum: a *high-point*, a *low-point*, and a *medial-point*. These, when paired, produce the *H/L*, *H/M*, and *M/L* combinations of the lightness series. *Definite sex differences are observed in the lightness series.* These sex differences may be organized according to whether the *H/L*, *H/M*, or *M/L* color-pairs are involved.

a. *The H/L color-pairs. The females preferred the lighter to the darker colors to a significantly greater extent than did the males.*

b. *The H/M color-pairs. The males preferred the lighter to the darker colors to a significantly greater extent than did the females.*

c. *The M/L color-pairs. The females preferred the lighter to the darker colors to a significantly greater extent than did the males.*

3. *Sex Differences within the Saturation Series*

As in the lightness series, we are dealing here with a psychological dimension along which three color-points have been selected that are equated in the Munsell system for hue and lightness; but which represent high, low, and medial positions with respect to saturation. *Clear sex differences were observed in the saturation series.* As in the lightness series, these sex differences may be grouped according to whether the *H/L*, *H/M*, or *M/L* color-pairs are involved.

a. *The H/L color-pairs. The males preferred the more saturated colors to the less saturated colors to a significantly greater extent than did the females.*

b. *The H/M color-pairs. The males preferred the more saturated colors to the less saturated ones to a significantly greater extent than did the females.*

c. *The M/L color-pairs. The females preferred the more saturated colors to the less saturated colors to a significantly greater extent than did the males.*

4. *Sex Differences with Respect to Color-Pairs Involving a Medial and an Extreme Color in Both the Lightness and Saturation Series*

Since we are dealing wiith two distinct psychological dimensions—lightness and saturation, one would not expect to induce a generalization regarding sex differences that would be true for both of these continua. If we note that four different hues, four different groups of psychiatric patients, and three distinct points along each dimension are involved—the emergence of such a relationship appears remote indeed. Nevertheless, such a relationship is strongly indicated on the basis of critical ratios and other indices that point to high statistical significance. This generalization may be stated as follows: *males tend to prefer the more extreme colors to the more medial colors to a greater extent than do females.* One wonders whether this medial-extreme relationship differentiates the sexes only within the realm of color experience—or whether it will be found to hold for many non-color psychological continua.

5. *Sex Differences with Respect to Color-Pairs Involving a High-Point and a Low-Point in Both the Lightness and Saturation Series*

On the basis of the findings in this area the following conclusion is indicated: *females tend to prefer the high extreme color to the low extreme color in the lightness series to a greater extent than do the males, while the reverse is true in the saturation series.*

D. Limitations of this Study and Suggestions for Further Research

It is desired, at this point, to discuss the meaning of the conclusions relating to sex differences in terms of the following set of facts: hedonic tone is a function of all three psychological dimensions of color; and the number of possible positions along each of these dimensions is large. It follows that the findings of this investigation may not be employed in any strict relating of sex and broad areas of color experience, but are meaningful (in a definitive sense) only within the color limits prescribed by the specifications of the particular colored materials employed. It is quite possible that color-pairs demonstrated to possess high sex-differentiating characteristics in some regions of the lightness and saturation dimensions may be ineffectual in other regions; and conversely, that continued research may reveal color-pairs of even higher differentiating power than those yielding critical ratios in excess of 4—herein noted. The realization of the latter possibility may provide the basis for a tool of value in investigations of sexuality.

In concluding, it is desired to point to some of the limitations of the findings relating to psychiatric groups. It will be recalled that two classes of color-pairs differentiated the color preferences of the anxiety neurotics from those of the other three diagnostic groups: the color-pairs of the lightness series, and the yellow-green pair of the hue series. Although critical ratios exceeding 2 are found in this regard with respect to both classes of color-pairs, evidence has been presented indicating that the differences obtained through the use of the color-pairs of the lightness series are more likely to reflect the influence of factors additional to chance than are those obtained through the use of the yellow-green pairs of the hue series.

On the basis of the findings described in this report one is tempted to go beyond the proper limits of this investigation so as to relate psychodynamics and color preferences in some definitive manner. An evaluation of the grounds for such an extension reveals their inadequacy. To translate covariance into causation on the basis of a single criterion is to run the risk of a gross error of abstraction. Criterion groups differing solely in one respect have never existed, and those employed here are not exceptions. They differ not only with respect to subjective anxiety experienced, but also with regard to the several uncontrolled variables already described as well as a host of unknown factors that are probably intrinsic to the mechanisms producing the various disturbances. This study is believed to offer sound evidence in favor of the hypothesis that anxiety is associated with a preference for lighter colors. However, the translation of this hypothesis into the realm of established principle must await further research in which independent criteria of anxiety are employed.

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